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PRESENTATION OF THE ALBERT MEDAL FOR 1954

His Royal Highness the Duke of Edinburgh, President of the Society, presented the Albert Medal for 1954 to Sir Ambrose Heal, R.D.I., at Buckingham Palace, on Wednesday, 21st July. The medal, as already announced in the *Journal*, was awarded to Sir Ambrose Heal 'for his services to industrial design'.

The presentation was attended by the following Members of Council: Mr. E. Munro Runtz (Chairman); Mr. F. H. Andrews; Sir Alfred Bossom; Sir Frank Brown; Mr. P. A. Le Neve Foster; Mr. John Gloag; Sir Ernest Goodale; the Earl of Halsbury; Mr. A. C. Hartley; Mr. F. A. Mercer; Sir Francis Meynell; Mr. O. P. Milne; Lord Nathan; Sir William Ogg; the Earl of Radnor; Mr. E. M. Rich; Professor A. E. Richardson; Mr. A. R. N. Roberts; Mr. Gordon Russell; Sir Harold Saunders; Sir Selwyn Selwyn-Clarke; Professor L. Dudley Stamp; Sir Stephen Tallents; Mr. William Will; Sir Griffith Williams; Sir John Woodhead, and Miss Anna Zinkeisen; with Mr. K. W. Luckhurst (Secretary). Mr. Anthony Heal was also present.

SWINEY PRIZE FOR 1954

Arrangements are now under way for the formal presentation to Professor G. W. Paton, Vice-Chancellor of Melbourne University, of the Swiney Prize which was awarded to him last January. The prize consists of a silver cup of the value of £100 and a cheque of a similar amount. Sir John Lienhop, Agent-General for Victoria, has kindly undertaken to act as the Society's liaison for the making of these arrangements, and, as a first step, he arranged a short private ceremony in his office at Victoria House on 30th June, when he formally received the cup from the Earl of Radnor, then Chairman of the Council, and made himself responsible for its transmission to Melbourne.

In addition to the Agent-General and the Chairman of Council the ceremony was attended by Lady Lienhop; Dr. R. W. Holland, Mr. E. Munro Runtz, Sir Selwyn Selwyn-Clarke and the Secretary (representing the Royal Society of Arts); Mrs. R. H. Boyd (sister of Professor Paton) and Mr. Boyd; Dr. J. A. Foster (Secretary, Association of Universities of the British Commonwealth); Mr. L. Illingworth (Manager, Australia and New Zealand Bank, Bendigo, Victoria); and Professor Charles Moorhouse (Professor of Electrical Engineering, University of Melbourne).

RECENT DEVELOPMENTS IN THE STUDY OF THE SENSE ORGANS

The Trueman Wood Lecture by

E. D. ADRIAN, O.M., M.D., D.Sc., LL.D., P.R.S.

Master of Trinity College, Cambridge, delivered on Wednesday, 17th March, 1954, with the Right Honble the Earl of Radnor, K.C.V.O., Chairman of Council of the Society, in the Chair

THE CHAIRMAN: This afternoon we are to hear the Trueman Wood Lecture delivered by Dr. Adrian. Sir Henry Trueman Wood was Secretary of the Society from 1879 until 1917 and served the Society for 45 years. A trust was set up to commemorate his great services to the Society and to provide this lecture every year. It is, I regret to say, rather a melancholy fact that only recently Sir Henry Trueman Wood's successor as Secretary, Mr. Menzies, who was a Vice-President of the Society, died rather unexpectedly. We regret his passing very much indeed.

So far as our lecturer this afternoon is concerned, he is one who, I think, is probably known to all of you. Many eminent men have honoured the Society by giving the Trueman Wood Lecture, and I venture to suggest that amongst them Dr. Adrian will not be the least eminent man who has done so. I need not go into the details of what he has done in the past, but you will know that he is President of the Royal Society. He is also the Master of Trinity College, Cambridge, and he is an Albert Medallist of the Royal Society of Arts. He is going to give us a lecture on the subject of 'Recent Developments in the Study of the Sense Organs', the subject on which he is pre-eminent.

The following lecture was then delivered:

THE LECTURE

In a lecture on the recent developments in some branch of science it is often a good thing to start with a brief historical sketch. It is a good thing for the lecturer to have to look up the history of his subject: it prevents him from plunging into technicalities before the audience know what he is talking about and as a rule it shows that, although there is still a great deal that we do not understand, we do at least understand a little more than our grandfathers. But when one is talking about the sense organs the historical gambit is really out of the question. Ideas about them must go back to remote antiquity. Primitive man would have only to shut his eyes or block his ears to have some knowledge of their function as sense organs, and as this function is to bring the world before our minds any historical treatment would soon be entangled in philosophy ancient and modern. It could only emphasize the fact that we are still a very long way from any sort of scientific picture of a sensation, though we may know something about the organ that is responsible for it.

However, I must not give the impression that this is a case in which history can be regarded as bunk. In the modern era physiology is a relatively young science compared with physics and chemistry, but although the scientific investigation of the sense organs and their action on the brain is all fairly recent, there was a great deal to be found out without going inside the body at all. The events which end in awareness take origin in the physical world outside and the whole picture of the physical world has been built up by their study. And it would never do for me to miss such a golden opportunity for boasting that I lived for four years in Trinity College in the rooms on the first floor between the Great Gate and the Chapel. As college rooms go they were not out of the ordinary, but it was in those rooms that Isaac Newton lived when he was at Cambridge, and it was probably there that he set up the glass prism which he had bought at the Stourbridge Fair and proved that white light can be made by combining the colours of the spectrum; and he was living in those same rooms that were afterwards mine when he measured the velocity of sound in Nevile's Court by clapping his hands regularly at such a rate that the echo of one clap coincided with the direct noise of the next.

It is of course true that the more recent discoveries in physics have brought a deeper insight into the nature of the external events which excite our sense organs but a text-book account of them written a hundred years ago would give the broad outlines: on the other hand, a text-book of that date about the sense organs would tell one next to nothing apart from their structure and very little about the finer details of that.

Knowledge of their microscopal anatomy came in the latter half of the last century when all the methods of histology were established, the fixing and staining of the tissues and the cutting of thin sections. Nowadays we have learnt almost all we can by these methods and if we want more information we shall have to get it from the electron microscope. Knowledge of the nervous pathways from the sense organs into the brain came later and it is still coming, and knowledge of the physical and chemical constitution of the sensitive elements has hardly begun to come. But knowing the structure of the sense organs does not take us very far. It shows us how the visual picture is focused on the sensitive elements of the retina by the optical system of the eye-ball and how the basilar membrane in the cochlea is caused to vibrate by sound waves reaching the ear, but that takes us only a little way beyond the surface and what we want to know is how the picture on the retina or the touch on the skin makes us aware of these events, or at any rate how it makes us carry out some appropriate response to them. These are two distinct problems and the first is far more ambitious than the second, for it brings in the mind as well as the matter. We could easily construct a machine which would say 'I see a light' or 'I feel a touch' when we shone a light on it or touched its surface, and we could arrange for it to turn its head towards the light or to scratch the place that was touched. The human body does not invariably scratch the place: it reacts in a far more complicated and unpredictable way, for what it does depends on all its own accumulated experience as well as on the way it was put together at the start. But it is certainly worth-while

to find out all we can about the machinery, the physical and chemical changes which take place in the sense organs and nerves and brain and muscles, and there is a great deal more to be found out about them before we need trouble about the difficulty of bringing the mind into it. And the position which we have reached encourages us to go on. We can follow the signals from the sense organs into the brain and we can follow those which the brain sends out to the muscles to make the appropriate response. It is of course in the brain that we must look for all the elaborations, the interactions of past and present experience and the emergence of one of many more or less suitable responses. The brain may defeat us by its great size and complexity and still more by our having nothing superior to our own brains to use in its study. At all events I shall try to show how this kind of study is progressing by describing what happens to the sensory signals as far as we are able to trace them.

First as regards the signals themselves. They have to be transmitted by nerve fibres, long threads of living matter a few thousandths of a millimetre in diameter, collected into nerve trunks but insulated from one another and running an independent course, from the receptor element in the sense organ or the skin up to their destination in the spinal cord or the brain stem. The receptor elements may be no more than the fine branching endings of a nerve fibre with its cell body near the central nervous system. This is the usual arrangement in the skin where there is a very large sensitive surface and a limited number of nerve fibres to carry the signals from it, though some of the fibres have their endings enclosed in a variety of capsular structures which may control the mechanical effects of the stimulus. In the large sense organs of the head, the eyes, ears and nose, the arrangement is different: a great many sensitive elements are closely packed at the receiving surface and they are cells rather than nerve endings, a hundred thousand or so in the ear, and several million in the eye and in the area sensitive to smell at the back of the nose. With sensitive elements—'receptors'—of this kind, a nerve fibre process, which may be very short, comes off from the base of the cell, and at the apex there is a tuft of fine hairs, or, in the retina, the special light sensitive structures called rods or cones.

The nerve fibres which carry the signals from all these different sensitive elements are not exactly all alike, there are considerable variations in diameter, rate of conduction, etc., and for all we know they may have important differences in their chemical properties. But the signals they transmit seem to be all of the same kind. As far as we know there is only one kind of change which living matter can transmit rapidly over considerable distances and that is a momentary disturbance of the surface with an accompanying change in its electrical properties. Such a brief impulse can be started by an electrical or a mechanical stimulus at some point in a nerve fibre and it will travel along the fibre at a rate of 10 to 100 metres a second. The impulses cannot be made larger or smaller, or faster and slower, by varying the stimulus but they can be made to follow one another at very short intervals, up to 1,000 a second in some of the larger fibres. The signals which come into the brain from the sense organs are all made up in this way, by trains of impulses which vary in number and in frequency but not

in any other way. We can detect them by recording their electrical effects, but if we did not know whether our records were made from the optic nerve or from a sensory nerve in the skin we could not tell whether the signal implied a flash of light or a touch.

It is, of course, a considerable simplification of our problem to find that the information which is fed into the brain is all expressed in the same form, but it would be a mistake to suppose that the form does not allow a great deal of variation in the message. The number of nerve fibres brought into action by a particular stimulus may vary from one to a thousand or more, and in each fibre a message lasting no longer than one-tenth of a second might have anything from one to fifty impulses in it, with all kinds of variation in spacing. It is in fact the variation in spacing which makes the message in a single nerve fibre able to convey far more information than whether the receptor has or has not been stimulated. Though the impulses are all alike and are very brief events they are transmitted to regions where they set up changes of a different kind, persisting longer and varying in intensity with the rate at which they are built up, so that a train of impulses could produce a variety of excitation patterns in regions of different time relations. In most cases a rise or decline in the frequency of the impulses seems to go hand in hand with a rise and decline in the intensity of the sensation we experience (if the message is one which evokes sensation), but the rate of rise and decline might also give information about the quality of the stimulus as well as its intensity. It has been suggested for instance that lights of different colour falling on the retina may give impulse discharges which have an initial spacing varying with the colour: it would be theoretically possible for the impulses set up by red light to come in pairs close together and those set up by a green light to come in triplets, though in fact this kind of spacing is rarely found except in highly artificial conditions.

There is usually a pretty close correspondence between the signals from the sense organs and the sensations which we experience when they are stimulated. The lightest touch we can feel is also the lightest touch which will send impulses up the nerve fibres from the tactile endings in the skin. The intensity and duration of the sounds we hear agree with those of the discharge in the auditory nerve. In the case of smell the impulse discharge set up by a material with a fruity or aromatic smell rarely persists between one breath and the next, whereas a material with a clinging smell like paraffin oil or coal gas gives a discharge which persists from one breath to another and does not disappear until some time after the stimulus is withdrawn.

To this extent our sensations seem to show a remarkably close relation to the signals which evoke them, but in one respect there may be an interesting difference. It has only appeared in the last few years and it concerns the phenomena classed as sensory adaptation. If a very light object is placed on the skin we are aware of the touch at the moment when it occurs but we may not be aware of any continued pressure. This is the natural consequence of the fact that the sensory discharge occurs only at the moment of contact because the sensory endings are only stimulated by the actual deformation of the skin or

movement of the hairs. But there are some sensory endings which may continue sending impulses to the brain long after the sensation has faded. I am not speaking of the many long continued signals which do not lead to sensation because they are directed not so much to the brain as to the executive part of the nervous system which forms the spinal cord. There is for instance a constant inflow of information from the muscles and tendons: it is essential for the fine control of movement but we are quite unaware of it and there is no evidence that the signals ever get as far as the cerebral hemispheres. With some sensory endings, however, a persistent stimulus gives a persistent impulse discharge but a sensation which soon dies away. This happens with sensation of temperature and of smell. The temperature endings in the tongue and in the skin have been investigated recently by Zotterman and his colleagues in Stockholm. His records show that there are some sense organs which begin to discharge impulses when their temperature is raised above the normal value and others which begin to discharge when they are cooled, but in both cases the discharge persists until the normal temperature is restored, whereas we very soon lose the impression that the skin has been warmed or cooled. With smells the evidence points in the same direction. A persistent smell in the air we breathe soon ceases to evoke sensation. We can sometimes recapture the sensation by sniffing hard and so increasing the intensity of the stimulus, but soon even this fails and we must spend a minute or more in the fresh air before we can detect the smell again. Here as with the temperature endings the records from the olfactory nerve fibres reveal no corresponding failure on the part of the sense organ. The smell of the air in an ill-ventilated room will continue at each breath to evoke a discharge in the olfactory pathways from the rabbit's nose for periods of an hour or more: it is possible that the human olfactory organ is more easily fatigued, but it is more likely that we cease to be aware of the smell because the brain is influenced by the signals only at their first appearance and has some way of becoming inattentive to them when they are giving no fresh information.

I have mentioned this because it raises one of the most important attributes of the brain as the organ which intervenes between the stimuli which excite our sense organs and our awareness of them. Though it is not true to say that we can only attend to one thing at a time it is true that our attention is usually concentrated on one particular field of sensation to the partial exclusion of other fields. Of course we can see and hear at the same time, but we can look so intently that sounds make little impression on us and touches and pressures on the skin none at all. But an unfamiliar sound or touch can distract us and sounds that we have reason to dislike may make it impossible to concentrate our attention any longer on what we are seeing. It seems then that the focus of brain activity can be diverted from one field to another according to the significance of the varied sensory messages which are reaching it. For mankind the information conveyed by visual messages usually has the highest significance and it is only by shutting our eyes that we can keep it from claiming some of our attention. We rely less on sounds and can turn a deaf ear to them and we rely so little on smell that we can only appreciate an odour when it is a relatively new experience.

The shifting of interest from one field to another depends partly on the physical attributes of the stimulus. A sudden change in the balance of the sensory pattern is much more effective than a gradual change, and an intense stimulus, a loud noise or a strong smell is more effective than a feeble one. But if the interest is to be maintained in one direction it is still more important that the sensory stimulus should be one which arouses further activity in the brain because it or some elements in it stir up the pathways formed by previous experience: a noise which evokes an unpleasant memory will be much more disturbing than one which is merely loud.

We know very little about the nervous organization of the brain which directs our attention one way or another. Since what does or does not interest us depends so much on the associations it brings up we cannot get much further until we know more about the physical basis of our memories and habits of thought and action. At present we are still without any clear picture of the changes which take place in the nervous system when a new habit is formed, whether it is one involving consciousness or not. But at least we can be sure that there are physical changes in the brain when the level and direction of attention changes. Nowadays it is not such an uncommon experience to have a record of one's electroencephalogram taken to assist the diagnosis of one's ailments. It is a record of the oscillation of electrical potential changes which can be detected on the surface of the head because the nerve cells of the cerebral cortex are setting up similar but larger potential changes beneath the skull. Anyone whose 'e.e.g.' has been recorded will know that importance is attached to the effects of opening and closing the eyes and sometimes to that of concentrating attention on non-visual stimuli or on problems in mental arithmetic. All these produce immediate changes in the record, some of them occurring over most of the brain surface and some localized to particular regions. We cannot expect that methods of this kind will allow us to arrive at a complete picture of what is happening in the brain; but we can certainly look forward to having a much clearer picture than we have now.

These new methods of investigating the sense organs and the brain have already given us a clearer picture of some aspects of the physiology of sensation, but they have also revealed some new complications. The cerebral cortex is a large sheet of nerve cells arranged in layers with their branching processes forming a dense network round the cells, and we have known for a considerable time that the main pathways from the different sense organs led to different regions of the sheet. We knew also that they were arranged so that for each sense the different points on the receiving surface of the sense organ led to corresponding points on the surface sheet of the brain. For instance the signals from the skin are sent to a long strip running down the lateral aspect of the cerebral hemisphere just behind the deep middle groove, the *sulcus centralis*, and in this strip the signals from the feet arrive in the upper part, those from the hands arrive lower down, and those from the face lower still. Thus contacts with the body surface are mapped out, so to speak, on a limited region of the brain surface. In the same way the retinal elements lead to corresponding points on the visual

area at the back of the brain and the basilar membrane of the ear is mapped out in the lateral, auditory area.

It is not at all surprising to find that the sense organs of each kind project on to the cerebral cortex a map of the events which they are recording at each instant. The combined information expressed in them should be all that is needed for building up a complete picture and the preservation of the spatial pattern at the brain surface seems to be a reasonable arrangement, though it does not take us very far. We do not know what comes next, where and how the information is combined and used to decide what we do, but that is another story. Recently, however, it has been found that even at this preliminary stage the story is more complicated than we supposed. The information from the different sense organs, at all events from eyes, ears and skin, is presented to the cerebral cortex in two quite different styles. Signals from the body surface reach what is now called Sensory Area I to form the large scale map of it already described and they appear also in another region nearby, Sensory Area II, to form a smaller map with a reversed orientation and less emphasis on detail.

These second areas have only been revealed by detecting the arrivals of the signals in the brains of anæsthetized animals, but Penfield has found some evidence for a second sensory area in the human brain by stimulating it electrically, creating artificial signals, so to speak, to find out how they affect consciousness. In the cat's brain the second area is behind and below the first: signals from the hind paws appear lower down than those from the forepaws (the reverse of the arrangement in Area I) but the signals from the surface of the trunk are much closer together and are harder to separate from them. The arrangement of the two receiving areas from the ear is even more complicated, though it is on the same lines. The first area is a continuous strip in which sounds of high pitch are signalled at the head end and sounds of low pitch at the tail end, and the second area is split into two with sounds from the middle octave downwards represented in the front division and those of higher pitch in the back. A second visual area of the same sort has been described, though we have less information about it: in the case of smell we have none, for the destination of the olfactory pathway is still obscure.

No one has been bold enough to hazard a guess as to the meaning of this doubling of the arrival areas in the cerebrum. The only hint we have comes from some evidence suggesting that the second areas with their less detailed mapping are part of a more primitive brain organization which has had new structures (including new receiving areas) added to it as the brain has become more elaborate. At all events the second areas are connected with the more primitive parts of the cerebellum and the first areas with those parts of it which reach their highest development in the monkey and man. It may be therefore that these second areas are survivals like the appendix, important only when something goes wrong with them, but there they are, and at present they are an unwelcome complication of our picture of the cerebral hemisphere.

But the signals from the sense organs do not go only to the cerebral cortex and there is another story about them which is easier to follow. It concerns a

diffuse mass of nerve cells at the head of the brain stem known as the reticular formation. Magoun and Jasper and others in the United States have shown recently that the sensory signals are sent to this region as well as to the cerebral cortex. It is the region which seems to control the general level of activity in the brain: when it is stimulated artificially the cortical cells are more readily excited and when it is destroyed the brain sinks into something approaching coma or deep sleep. It follows that if the reticular formation is stimulated by the arrival of a signal from a sense organ the whole brain may be roused to greater activity. Apparently the formation is equally accessible to all the signals that come to it and their effect will depend on their physical intensity rather than on the kind of information they convey. But this initial alerting of the whole brain may be a necessary step if the cerebrum is to receive the information and determine its importance. If the brain is asleep a sound may have no meaning, if it is partly awake the meaning may rouse it to further activity.

It would not do to pretend that this brings us much nearer to an understanding of how our attention ranges from one thing to another, but it looks as though the reticular formation is an important factor in deciding how much attention is available. It is a very small mass of nerve cells compared with the immense mass in the cerebral hemispheres and it is unlikely that it has much to do with all the detailed analysis of information which must take place in them, the abstraction of patterns which fit in with those already laid down, the arousing of emotional activity and so forth. We are still a very long way from all these concomitants of thoughts and ideas and desires. So, as I said at the outset, though we may find in the end that our brains are too elaborate for us to understand it is worth trying to do so by tracing the fate of the signals on which they have to work. I think we are a little nearer the threshold of the mind than we were: fresh information about the action of the sense organs may be leading us up an alley which will turn out to be blind, but it is an interesting place for the physiologist to explore.

THE CHAIRMAN: I feel quite sure that the audience would like me to express very sincerely their thanks to Dr. Adrian for his extremely interesting lecture. I cannot pretend that some of it was not rather above my head, even though he made it as simple as it could be. I also feel that he may have given me some excuse for mental aberrations which I can now put forward as having the authority of somebody as eminent as himself. I should like, therefore, on behalf of everybody here to thank Dr. Adrian very much indeed.

The vote of thanks was carried with acclamation, and the meeting then ended.

THE IMPROVEMENT OF CARGO-HANDLING APPLIANCES

Thomas Gray Memorial Trust Prize Essay by

CAPTAIN F. D. GARDNER

of the s.s. Sugar Refiner.

In dealing with this subject I think it is best, at the outset, to concentrate upon ships' gear, since the time is still far distant when crane discharge and load and other shore applied mechanism will completely oust ship appliances.

Undoubtedly the electric winch has been the greatest boon of recent years, and it is on the extension, improvement, and standardization of this that we should first concentrate. Apart from any other considerations I know of no steam winch which allows the efficient operation of two simultaneously by one man, as is possible with electric winches. The whole question of electric *versus* steam winches has never, to my mind, been tackled broadly enough to give the economy which could result from combined operations on the part of managements and superintendents in consultation with producing firms. The result has been that too many electric winches have been turned out for ships—instead of shipping—at a higher cost than necessary.

In this connection the question of electrical supply is important, and I visualize a time when a standard equipment for engine room and deck, according to the number of winches (including windlass and mooring winches or capstans) necessary to suit the trade and operations of the ship, will be sufficient for all cargo-handling needs. It seems to me—though no technician—that a standardized electrical winch could be made simple of upkeep by the provision of interchangeable spares, which would not need skilled labour to dismantle and replace and of which the worn parts could be left ashore for re-conditioning at leisure.

With winches comes the need for easier adjustment of topping lifts. It is astounding to see, even on modern vessels, an arrangement by which several men are needed to 'hang off' a topper with a chain stopper, release a kinked wire from dangerous cleats, 'take to' a winch from which the runner has had to be released, adjust the derrick after releasing the stopper, and then practically repeat the operation backwards to make the derrick safe for use again. Though one may rightly say that with an experienced crew the time occupied is not as long as the operation would appear to need, the total loss is considerable if, together with the time taken, one adds the delay caused to cargo work by the derrick failing in the end correctly to plumb the job. Moreover, we need something that can be operated by the one winchman: hence my suggestion.

Since there is little need for inboard winch-ends to-day—since whips are seldom used—why should not topping-drums take their places? The single topping wire could run through a lead on the mast or deck to the drum, which

The full title prescribed for this essay was "The improvement of cargo handling appliances on board ship and on the quayside: with special reference to the need for self-sufficient arrangements in times of emergency and the overriding consideration of keeping costs low."

could be clutch-operated to gear to the winch. In conjunction with this the topper could pass through a compressor, which would act as a stopper and preventer to save undue stress on the topping-drum and would also allow the topper to be instantly run off should the drum be needed for, say, taking a guy to it during a heavy lift. Some Scandinavian vessels have a separate hand-winch for topping derricks, but such winches are of necessity light and a preventer is still advisable, if not essential. The topping-drum would be an improvement on the hand-winch.

Guys and preventer-guys have always seemed to me to do the same job and one should suffice. The only justifiable need for both is that the guy tackle, being of rope for easier man-handling, is subject to chafe not always discernable. In advocating a single wire, a continuation of the pennant, to be taken through leads on the bulwark rail or on deck, and passing through compressors to a hand winch, I know I am involving an extra expense at the outset and possibly some technical difficulties, but on the score of self-sufficiency and economy in the long run I feel sure that the use of a single wire and the absence of a preventer would make for ease and labour-saving. One should remember also that the use of the swinging derrick with its need for constant guying is almost a thing of the past.

Now to the derricks themselves. As the 'yard and stay' method of cargo work is most often employed, derricks need to be long enough to span an inside truck road or an outside barge. Often one sees a derrick that has to be lowered to a dangerous angle, involving not only undue strain upon the gear but the delay and damage consequent upon cargo catching the coamings, bulwark rails or truck sides. Derricks have been limited in length mainly through consideration of length of hatch and flat stow. In some cases nowadays one sees the flat stow ignored and a longer derrick stowed at an angle. Why not, where a longer derrick is desirable and the ship design does not permit of flat stow, allow the derricks to be stowed upright alongside the masts or the samson posts? Crutches that clamp the derricks in an upright position should not be much more costly and the stability factor would in few cases be noticeably diminished. Though less artistic, and perhaps more uncomfortable for the modern seaman, the increased self-sufficiency justifies the case for the upright derrick, in addition to the increased length that can be employed. Everyone knows that it is so much easier to lower a derrick into working position than to heave one up to it. The economy in time and man power here (especially in the many cases where it is not possible to prepare derricks before arrival at ports) would be considerable.

Hatches are the next thing that can be improved. The steel-type covering, fitted to most modern colliers, is becoming increasingly used for deep-sea ships. One wonders if the idea could not become a general substitute for the present hard-working loose hatch boards and tarpaulins, or if, alternatively, there is not a compromise method along the lines of, but an improvement on, the corrugated joined steel hatches employed in some ships. The warehouse roller-blind door idea I have often heard suggested, but of course it fails on the grounds of strength and stowage. One feels that it should not be beyond the

bounds of a naval architect's abilities to find something between the two which would combine strength with ease of opening and closing, and which one or two men could operate by using the winches. The use of sliding or roller beams would facilitate this and the topping-drum I have already favoured could be utilized. In any case I feel that, where tarpaulins remain a necessity, a more substantial single one could be devised to replace the present three, and the one I have in mind would also serve as a cargo tent for wet-weather operations.

'Tween deck hatchways lend themselves even more readily to quick covering and there seems no reason why the small single hatches should continue to be a source of work and worry here. I feel confident that a roller blind type of steel covering to stow under the deck head of the lower hold, or steel or alloy sheets to stow on to the 'tween deck (the main deck in the case of shelter-deck vessels) could be worked out economically. The latter, to my mind, could also be made to serve as hoppers for bulk grain cargoes. While on the subject of 'tween deck hatchways I suggest that trimming hatches, where necessary, could be made larger with advantage to other than bulk cargoes, and be fitted with sliding hatches similar to those I envisage above.

Hatch coamings and hatch beams could be made with fewer of those sharp edges on which shackles, crane-babies and grabs delight to hang themselves up, causing damage and delay. Improvements have been made but there is room for more—without any loss of strength or increase in weight. Larger hatchways have proved themselves worth-while but are probably reaching limitation point. A few substantial stanchions, where essential, at hatch corners are better for cargo working than the smaller but more frequently distributed ones. The larger hollow ones, though subject to denting, are to be encouraged as, apart from less broken stowage, they tend to make better leads for runners and crane wires, and thus easier loading and discharge.

In holds, although broken stowage has been reduced by less stanchions and impedimenta, space is often lost and chogging made more necessary through lack of leads, fittings for hooks, blocks, shackles, slings, etc. This simple lack can be responsible for many wasted man-hours, as I know personally. The point does not seem to have been studied, and 'the stevedore will manage somehow' seems to have been allowed to suffice. The point becomes even more important when we consider self-sufficiency in times of emergency, for the ship has not the gear available that the shore stevedores have. I suggest here that a comparatively inexpensive help would be to provide steel bars, judiciously placed, between beams at the deck head—especially in the 'tween decks—and a number of lightening holes in the frames at the ship's side, insufficient to weaken materially the structure. The bars, as well as giving provision for hanging tackles, would serve usefully for the stowage of dunnage—that bugbear.

The stowage of case and general goods brings me to a matter that I think needs more co-operation between ship and shore and between management and merchant. It seems to me that cases are now made only with a view to holding the contents but never with consideration for ship stowage. With little adjustment I think it will be found that cases, at any rate those containing any

one particular class of goods, could be made more evenly dimensioned. By this I mean that if one car for instance is a few inches longer than another the cases for both could be of the longer length without loss of stowage but rather with advantage in a ship's hold. Similarly it will be found that many cases are not quite twice their breadth in length. By making them exactly so it is obvious they can be evenly stowed in twos on top of each other, alternatively fore and aft and athwart. The extra taken up in case is more than compensated by easy and firmer stowage, less packing and chocking, etc. To extend my idea still further we could conceive cases made proportionate to children's building bricks, which fit on to one another with firmness and no loss of space. Of course manufacturers could not go to extremes involving big changes in their methods of packing, but I am certain that much could be done with little change to standardize cases of similar goods. The advantage of even flooring as cases are built up in ships' holds would be tremendous even by itself.

I should like to carry this a step further by suggesting that most cases, having to be stiffened on the inside in any case, could with advantage be made so that the stiffeners were capable of taking the lift, and if they were finished off with a self-stowing ring or sling much time in all-round stropping could be saved and a neater stow could be achieved. Where it is not possible to have self-contained slinging arrangements I advocate the use of flat bar grabs for lifting enough to sling or unsling: not those treacherous dog-type things that tear cases to pieces and sometimes hold, but ones with more of a nutmeg-grater grip. Before ending on case goods I should point out the great advantage in wagons too if cases were more evenly dimensioned.

This brings me to packages of a lighter type, for which I suggest a greater use of containers. This also involves my previous point, for the containers could be evenly made, say, with the length being twice the width and the height being the same as the width. Such containers could, I believe, be made collapsible for easy stowage and return when empty. I well remember a time when light soap packages were handled singly involving an enormous labour staff. Containers made possible a coastal trade that would not have been economically possible without. The idea has not been extended sufficiently. I was able to apply it in a smaller way to bricks which had hitherto in that part been handled with great skill in threes. Yet, comparatively recently, I have seen light packages stowed singly in the 'tween decks delaying the ship at the last several hours more than would have been the case had the packages been in containers. In this instance breakage and pilferage occurred that would not have been possible with containers. Neither was any advantage gained in the number stowed singly compared with what could have been stowed in containers. From our point of view I am sure we would rather lift containers on board than trays loaded with packages. There is the added advantage that containers can be stowed on deck.

Both with cases and containers the fork-lifting runabout could be more employed than at present on board ship for stowage in holds and 'tween decks. It makes for self-sufficiency. In the United States I have seen it used to better advantage than in England and I have seen a rice cargo in bags loaded with

its aid with very few men employed because, with co-operation between the ship and the shipper, the cargo was already stacked on suitable trays in the warehouse, the fork-lifters placed the trays on the sling for the derricks to lift to the hold, the fork-lifter in the hold off-loaded the tray and stacked it. The trays went with the ship—as the containers would—and were returned with the next cargo back. With my idea of even cases and containers a fork-lifter would be able to work upwards in the holds as the cargo was loaded and downwards as it was discharged. This, I suggest, approaches the aim we have in mind, but, of course, the greatest co-operation is essential between all interested parties.

The grab has come into its own for the working of many bulk cargoes, but I am assured that in England an equivalent saving has not been experienced owing to a Union rule which compels the use of sufficient dockers at the start to be able to do the clearing up at the end. Surely if small power ploughs were used for clearing up the Unions could not then justify such extreme waste of man power. The fork-lifting runabout I spoke of could be easily fitted with a plough for clearing up bulk cargoes. Incidentally, grabs can be used very effectively with ships' derricks and their use for bulk cargoes would make the ship self-sufficient in an emergency.

Timber cargoes, that is D.B.B.s, remain one of our slowest working commodities. The reason lies in their very varied character, with so many assorted sizes and lengths. This practically prevents the use of any mechanical means for the actual bundling of the timber which must be made up by hand into the slings for loading or discharge. One hesitates—especially one not connected with the trade—to suggest that this could largely be remedied by better co-operation between all parties concerned, but when one sees the remarkably quick handling that can be done by motor timber drugs where they have even stacks over which they can manœuvre one wonders if a mechanical clamp, to be operated by derrick or crane, could not be devised for timber cargoes. Indeed one feels sure something could and would be done in that line, if only even sizes and near-even lengths could be loaded together and discharged together. I understand that a type of grab has been tried on timber and failed for the very reason of the assorted nature of the cargo. Pit-props, of even length, have been so discharged. One could have hoped that with government cargoes, not destined for any one particular merchant, the Timber Control would have initiated a movement towards larger parcels of one size and fewer parcels in each ship instead of, as now, each ship having many parcels of many sizes. If so, I feel sure the possibilities of mechanical discharge would have been more obvious and a move towards that possibly started. As it is,, I think the question bears investigation with a view to speeding up timber cargoes while in no way damaging the merchant's interests.

I sometimes wonder if anybody has ever considered the belt-elevator as an auxiliary of cranes apart from its use as a separate unit. Although if a crane is available there is usually no need for an elevator, there are some bag cargoes where discharge is slow because the making up of slings is handicapped by the

nature of the bags. If a belt-elevator could be attached to the crane in such a way that the drive was from the existing crane motor a quick change over from crane discharge direct to elevator *via* the crane could be made when it was seen that the normal crane discharge would be slower than the belt-elevator. It could be made to stow well clear of the crane when not being operated.

On the subject of cranes (I am thinking of electric rather than hydraulic or steam cranes) I have wondered too if it would not be possible to train ship personnel in the handling of these. The time might come again (remember 1926!) when ships would have to be discharged, or loaded, by crane without shore labour, and it would be a pity if willing ship crews were handicapped by want of 'just a crane-driver'. Crane-driving is not in itself difficult, but it needs practice.

Improvements in shore wagons would be a great help to cargo-handling. These have altered little, and one still sees the 6 to 8 tonners—the laughing stock of other nations. Even allowing for antiquated rails with tight bends the size of wagons could be improved, since this need not necessarily entail a longer wheel base. Two-truck stowage in one should be the aim whenever a wagon is condemned (one wonders if some of them are ever condemned). While it is doubtful if this country could run 40-tonners I am sure the 20-tonner could become a commonplace instead of a rarity. This alone would cut delays in wagon shifting and shunting on quaysides by nearly half. Then—though this is a matter that concerns the railways more than shipping—the outboard link-slip lever for uncoupling, with the automatic gear for coupling, would save the delay that is caused by shunters having to dodge under wagons for both coupling and uncoupling. (At present, the dockers often relieve them of the second operation but there is still delay—and risk.)

At wharves where it is necessary for a ship to shift often for hold-to-hold discharge or loading, I suggest that time and money would be saved by the installation of shore capstans, or other haulage machinery, at suitable points for this purpose instead of relying upon ships' gear and crews. This would not, of course, relieve the ship of her responsibility and she would have to shift moorings, but the saving of time through the fact that the ship would not have to study every mooring line all the time and that the shore people, having control, could halt the ship just where they wanted her, would be considerable. Another factor is that by shore capstans the ship could more easily be held alongside when shifting with off-shore winds. All these would save time.

Warehouses, where it is not desirable to have them flush with the quayside, could often make direct use of a hoist for ship discharge or loading by having swinging gantries—covered in if needs be—which could be brought out to the quayside, with telescopic extension platforms to extend out, after the gantry is in position, over the holds. Direct warehouse work in this way is available in times of emergency as the firm owning the warehouse need not be obliged to employ the normal dockside labour. Delay sometimes happens at warehouses, owing to a ship lightening and rising unfavourably to the shore platforms where the ballast cannot be run up as fast as the discharge is taking place. Yet frequently

there is water discharge from factories nearby going to waste in such places. This could be diverted for ballast purposes, and I know of one case where it is so used.

Finally, I think one of the best cargo-handling appliances is often missed: the mate himself. He may be consulted over the stowage, the trimming, the gear, but rarely over the actual cargo-handling. Often, indeed, he has difficulty in finding the right person to give an order when he needs some alteration in the loading or discharge. Of course, if anything goes wrong somebody will find him quick enough. But, in the matter of the actual cargo-handling, he is ignored, often when his advice could expedite matters. Head stevedores and cargo superintendents should be told to consult the mate more frequently as to how cargo-handling in the particular case could be improved. The mate should be given more authority to effect improvements where he can see a better or more economical way of going about things and there should be some sort of incentive to encourage him in this effort. Where possible—though unfortunately this is rarely permissible—he should be allowed to utilize his own crew where a speed-up can be effected without undue interference and without treading too heavily on dockers' corns. Frequently when clearing up a cargo such opportunities occur. This raises the question too as to what appliances a ship should carry, additional to the standard cargo-handling equipment, that would be useful in emergency, justifiable on other grounds, and, withal, that would not be economically unsound to have idle for long periods in view of the lack of efficient storage space in most ships. While the answer must vary with the class of ship and the cargoes she carries, I think a runabout truck fitted with fork-lifting and a plough attachment, a set of light roller conveyors, and some wire-mesh cargo nets, should be available for the mate's use on most ships. Beam clamps and dockers' hooks should be available in all ships' stores.

NOTES ON BOOKS

GOTHS AND VANDALS. *By Martin S. Briggs. Constable*, 1953. 30*s*

This is one of those rather rare books which take the antiquarian and æsthetic reader through pleasant paths of scholarship and taste without providing irritants for those who search diligently for minor defects conducive to superior sniffs.

The survey of 'Destruction, Neglect and Preservation' is unhappy reading as a record, yet the book is delightful. The thoroughness of research and documentation with the catholicity of æsthetic appreciation are fine correctives to the exclusive attitude of zealots who cannot exalt one period or system except at the expense of others, while the temperate and judicious presentation of the subject is far more effective than contemptuous wrath and invective—comforting as they can be! Mr. Briggs' charming literary manners almost rob one of some cherished misjudgments and pet hatreds. In short the whole book is a balanced and sympathetic account of vandalism, neglect, folly and the endless struggle against them, throughout some twenty centuries.

A special charm is the wealth of information about individual architects, often from their own writings, and, apart from the primary purpose of the book, there is much important matter which could only be otherwise assembled by laborious search.

Such men as Wyatt receive credit where it is due, but the atrocities committed by him seem almost to justify the violent detestation in which both Carter and Pugin held him. Mr. Briggs enumerates Wyatt's activities at length but seems to be too charitable in the impression he conveys of his treatment of Durham Chapter House. He tells us that Wyatt's ground for this was a delapidation so serious that funds were insufficient for proper restoration, but the money spent without any reasonable grounds whatever destroys the excuse. The author does not tell us that, in a meeting of the Chapter, held 20th November, 1795, 'it was ordered that the old chapter-house being pronounced by Mr. Wyatt to be in a ruinous state, be taken down by Mr. Morpeth under contract, also that a new room be erected on the same site according to the plan given in by Mr. Morpeth'. The Dean, who afterwards disclaimed any part in this transaction, and asserted that he had not even been consulted, was actually present at this meeting. John Carter the famous contemporary antiquary maintained that Wyatt's report as to the state of the chapter-house was totally devoid of foundation. Morpeth began by suspending a man over the vault to remove the key-stone so that the whole crashed down on the ancient gravestones.

Other Durham proposals by Wyatt were defeated. Terrible as they were I can only quote here the proposal to destroy the lovely Galilee to make a carriage way. The destruction had actually begun when the Dean returned to residence and found what was happening. Carter is quoted as saying—in 1807—'Nothing but devotion to novelty and hatred of antiquity governs all these undertakings'. The author hints at a personal grievance as the cause of Carter's enmity, an explanation which seems entirely unnecessary in view of Carter's unique position as a brilliant antiquary with a true artist's sensitiveness to Gothic art in an age when its champions were few and feeble. His beautiful drawings capture the medieval spirit, with freedom and yet with accuracy of detail. He had just reason for fury and even for hatred and Wyatt's obstinate obtuseness and his 'streak of megalomania' may well have engendered feelings that became personal. Pugin, thirty years later, said 'All that is vile, cunning and rascally is included in the term Wyatt'. The reader will find the rest of this quotation on page 156 and the present amplification of the records of Durham horrors reflects in no way on the author's treatment of Wyatt's whole impact on architecture. One has to admit that valuable work was done, for instance at Westminster, but one's relish in reading the comminations of Carter and Pugin assures one pleasantly of the incurability of one's own hatred.

Much that is horrifying in the book is lightened by the humorous side and by the inclusion of harmless follies and the quaint mixture of genuine perception and charming puerility in the Strawberry Hill confections. For the rest we have an able and fascinating study of the two Cromwells and an analysis of the whole period which includes the Dissolution, the anti-papal iconoclasm and the impact of the Civil War.

Henry's spoliation is put at some £50 million at present values, which Mr. Briggs says was nominally for the purpose of promoting education and other beneficent social or religious purposes, yet elsewhere he says that the whole process resembled the policy of 'redistribution of wealth that is so popular to-day in certain quarters and so unpopular in others', and that Henry VIII 'actually wanted the money for rearmament against the French'. Fifty million for 16th century military preparations? On page 32 we are told that 'All over the country relics were being destroyed, miracle-working images taken down and their crude machinery exhibited to the people on whose credulity it had imposed' but it has been said that stories of trick-images were often trumped up or grew from idle rumour. Is there here a matter for some thorough research?

Mr. Briggs' almost-divided mind about the north west tower at Canterbury is not only a condition of many but typifies a vital existing problem in hundreds of proposed restorations, and the responsible persons have to learn that they must face fierce disapproval and even Puginistic blows whatever the methods they adopt.

William Morris' splendid letter to the *Athenæum* is a delightful introduction to a final account of present-day efforts, resources, Acts of Parliament, administrative bodies and much else of the highest practical value to all concerned with the care of ancient buildings.

Author and publishers are to be congratulated upon the beautiful illustrations, and the index is full and accurate.

R. P. HOWGRAVE-GRAHAM

INTO SPACE. *By P. E. Cleator. George Allen and Unwin*, 1953. 15*s*

The author of this book was the founder in 1933 of the British Interplanetary Society; at that time the idea of space travel seemed to almost everybody absurd and its protagonists enthusiastic but misguided eccentrics. But the members of interplanetary societies in this country, in America, and on the Continent, studied the problems seriously. They saw that the only possibility of space travel lay in the development of rockets. But rocket research in this country was officially frowned upon and hedged round with all sorts of prohibitory regulations. It was otherwise in Germany where its importance for wartime purposes was foreseen and research was encouraged, so that the German V1 and V2 weapons were developed from the early experiments.

The German successes with these weapons have entirely altered the outlook. Great efforts and large sums of money are being poured into the development of long-range rocket projectiles. They will be strategic weapons in any future war. Some dividends are fortunately being obtained from these developments in the form of additions to our knowledge of the conditions in the upper atmosphere, of its composition at different altitudes, and of the spectrum of the sun in the far ultra-violet, a region which has hitherto been inaccessible because the short wave-length light is completely absorbed by the ozone high up in the atmosphere.

The idea of space travel has become commonplace. Every schoolboy is now familiar with it. There is nothing inherently impossible in shooting a rocket from the earth's surface into outer space. But the difficulties must not be underestimated; space travel is not just round the corner. An enormous expenditure of manpower and of money would be involved. It is estimated in this book that a six-ton rocket could be given sufficient speed, by a three-step process, to escape from the earth's gravitational pull: but for this the weight at the start would need to be 24,000 tons, of which 22,734 tons would be the weight of the fuel and 1,266 tons the weight of the rocket itself. Of this total weight 1,200 tons would be detached at the end of the first step and 60 tons at the end of the second step; they would fall to earth—somewhere. All this mass is needed to impart a sufficiently high speed to the six-ton rocket, which would carry passengers and their equipment—and these figures neglect the effect of the resistance of the earth's atmosphere.

The conditions for reaching the moon would be slightly more favourable, but of course the rocket, if manned, would need to carry a supply of fuel for the return journey from the moon to the earth. Though it would be very much easier to escape from the moon than from the earth, because of its relatively small gravitational pull, the addition of this extra load would be a very serious complication and would add enormously to the difficulties of the initial projection.

To avoid some of the complexities the suggestion has been made that a space station should first be established as an artificial satellite of the earth. The attempts to reach the moon or the planets would be made from that station. It is assumed that it could first be assembled and tested on the earth, then dismantled, and the pieces taken to their destination by spaceship, unloaded into space and then re-assembled. It does not require much imagination to realize the difficulties of this task, the assembly having to be made by men working out in space in a vacuum.

All these and many other matters are discussed in this book, which gives a good

account of early rocket developments, and of the different types of fuels and oxidizers. It will interest all who are attracted by the idea of space travel. The author inclines to the view that this century will see the triumphant reaching of Mars and Venus by man: I am not myself at all optimistic about the prospects of even the moon being reached by that time.

There are several incorrect or misleading statements on astronomical questions. In the footnote on page 59 the statement that Sir George Airy, the Astronomer Royal, could not be bothered to institute a search for the unknown planet predicted by Adams is not correct. Because the Greenwich Observatory did not possess so suitable a telescope as the Cambridge Observatory, Airy pressed Professor Challis in Cambridge to search for the planet and offered to loan one of his own staff for the purpose. Challis had, in fact, twice observed the planet without realizing it before it was found by Galle in Berlin.

It is not correct to state (page 60) that the age of the solar system is not to be compared with that of the universe. The evidence is that the ages of the solar system and of the galaxy are about the same. The age of the universe is not known: according to one view it is about the same as that of the solar system, though another view suggests that it may be infinite. The explanation (page 62) of the formation of binary star systems by the fission of single stars is now discredited. The external galaxies are not clusters of about 100 million stars (page 71); there is evidence that this figure needs to be multiplied by a thousand.

H. SPENCER JONES

THE CULTURE OF SOUTH-EAST ASIA. *By Reginald le May. George Allen and Unwin, 1954. 42s*

This book, in some two hundred pages, sets out to provide an outline of the history, architecture and sculpture of Burma, Siam, Malaya, Sumatra, Java and French Indo-China. This intent is admirable; the task has not hitherto been attempted, and an understanding of the cultural background and interrelationship of regions which are pivotal in the future of Asia is timely. The subject can no longer remain the preserve of the specialist. To put the matter at the lowest, it is now the duty of the educated layman to give some passing attention to it if he is to read his newspaper and form his remote opinions with intelligence.

From the time of Lord Macaulay to the present day the alien East has maintained its essential inscrutability to Western eyes, in spite of the intermittent efforts of interpreters on both sides. The Eastern habit of seeking in abstraction a refuge from an overpowering environment fits ill into the kindlier domesticity of Western tradition. Dr. le May, who spent twenty-five years in the East, is at pains to attune his reader's mind before confronting him with the material evidence, and would have achieved his object more successfully with a somewhat less didactic and egotistical style. Irritating and irrelevant interjections ('As I pointed out to Lord Zetland when he came to visit the exhibition of my collection of ancient sculpture at India House in 1938 . . .', and the like) tend to divert the reader too frequently from the honest common sense into which they intrude. Purged of this tendency towards ostentation the book could be hailed as a concise introduction to a peculiarly complex subject.

That subject is one of fascinating interest. The peaceful penetration of South-East Asia by Indian cultures during two millennia is a phenomenon without parallel in history. No equivalent of the Macedonian phalanx or the Roman legion or the armed Crusade prepared the way for it. Trade and tolerance were its two weapons, and their success is to-day a moral lesson to a quarrelsome world. In detail, the study of them becomes largely an analysis of the various fashions and degrees in which the local genius, from place to place, transmuted the Indian material, and in this sense the problem has a superficial analogy with the corresponding study of distributed

Hellenism. But the Greek, at heart more militant than the Hindu, was less sympathetic to the *genius loci*; he produced varieties of provincial Hellenism, but never, unless at Rome itself, ingenerated a substantive and vital growth such as that which flowered from Indian seed at Angkor or Borobodur. The author notes or hints at the particular individualities of these offshoots of Indian Buddhism and Brahmanism, region by region, and, with a bibliography, points the way to an ampler consideration of them. He illustrates his remarks with two sketch-maps and 216 useful photographs, mostly of sculpture. But the photographs unfortunately lack indications of scale, their numbering is erratic, no dates are given in the underlines, and no page-references. All these omissions are worth putting right. It may be hoped, too, that in a future edition more space may be devoted to the architecture. There is only one (inadequate) plan, and no clear picture of these very remarkable buildings is left upon the mind of the newcomer. Certain sites of considerable interest, such as Oc-Eo in Indo-China, where the French have dug since the war with results of some importance, are omitted altogether. With revision of this kind, the book should reach and interest a considerable public.

R. E. MORTIMER WHEELER

FROM THE JOURNAL OF 1854

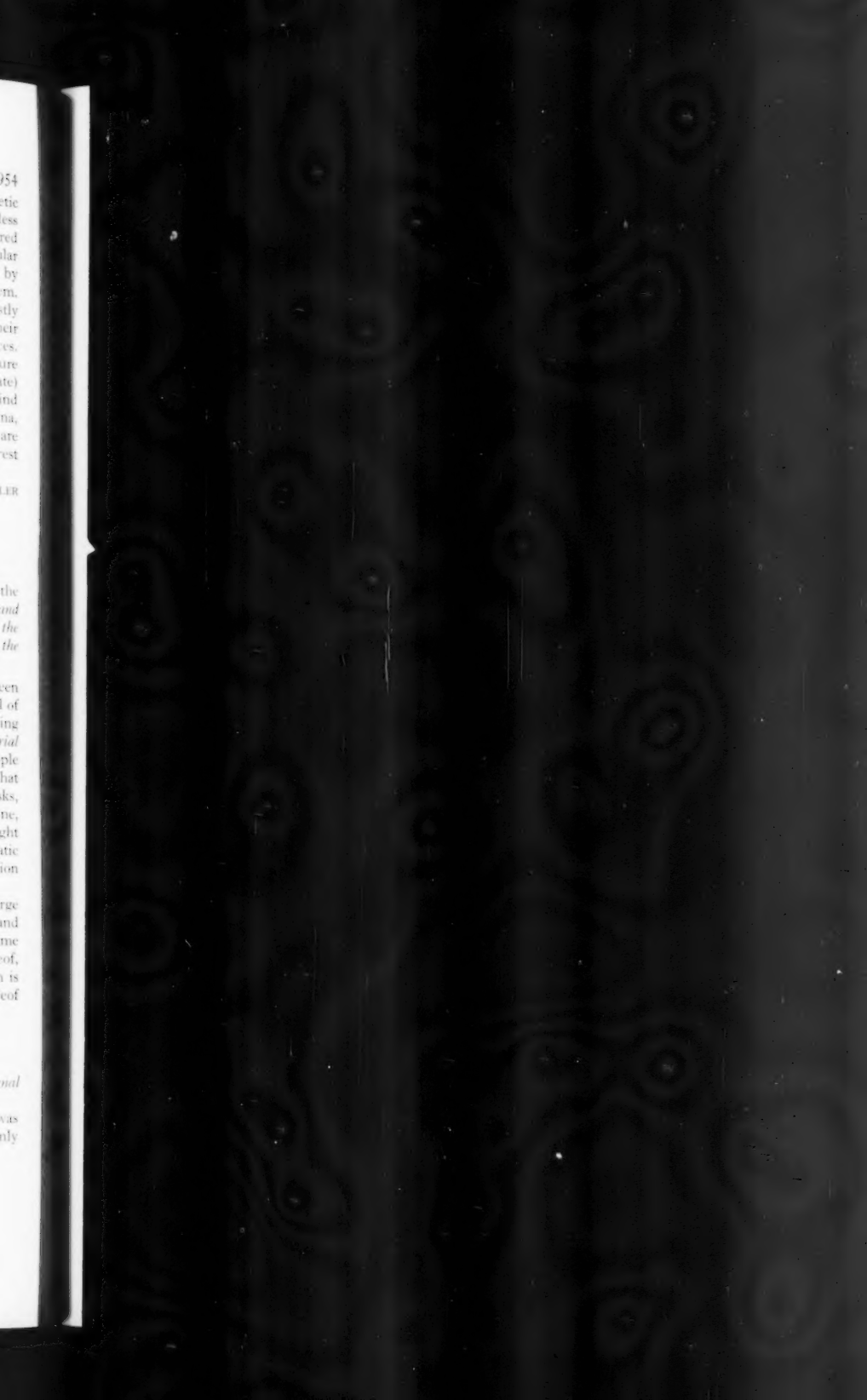
VOLUME II. *4th August*, 1854

The following extract is from a lecture on School Discipline, and Its Effects on the Behaviour of Children, *by the Rev. J. P. Norris, H.M. Inspector of Schools, and Fellow of Trinity College, Cambridge. This was one of the lectures delivered at the Society's Educational Exhibition to which reference was made in the last issue of the* Journal (*pages* 752–4).

The lecturer explained the purpose of his address, by stating that he had been invited to give it in consequence of a letter which he had addressed to the Council of the Society of Arts, expressing his apprehension of one possible danger attending this exhibition—the danger of an undue prominence being here given to the *material* as compared with the *moral* elements of a school's efficiency—the danger of people going away with the notion that a school's excellence depended more upon what was here so largely represented—the form of the building, the shape of the desks, the apparatus—than what alone gave value to all these appliances—the discipline, the temper of the government: the *moral* influences, in short, that were brought to bear upon the children. He was desirous that in this lecture-room an emphatic protest should be entered against any such mistaken inference from the Exhibition upstairs. . . .

We might do well to remember that he who of all others was least open to the charge of want of faith in education, who might rather be called its best vindicator and assertor, the great advancer of learning—Lord Bacon, had expressed the same doubt. Speaking of mere knowledge, he said that, 'Without the corrective thereof, it had in it some nature of venom or malignity, and some of that venom, which is ventosity or swelling'; and he added, 'This corrective spice, the mixture whereof maketh knowledge so sovereign, is *charity*'.

ERRATA

The photographs reproduced on pages 695 and 696 of the last issue of the *Journal* were taken by Mr. A. C. Hartley, not Mr. A. E. Hartley as stated.

In the note on *English Weathervanes* by Mr. A. Needham, on page 752, it was erroneously stated that it contained 81 drawings. In fact, the book, which is the only comprehensive work on this subject, contains 275 drawings.